

**CULTURAL DATA
SCULPTING
REPORT**

June 2021

TATE Subjects Visualized

An interactive dataset visualization

Ludovica Schaerf
Final report
Digital Humanities Master

TABLE OF CONTENTS

1. SUMMARY OF PROJECT	2
2. INTRODUCTION TO THE ARCHIVE CHOSEN	3
3. INTRODUCTION TO THE DATA VISUALIZATION	6
INTENTION (WHAT ARE YOU TRYING TO SHOW)	
4. CONCEPT MAP OR INTERACTIVE SCHEMA FOR THE	9
VISUALIZATION	
5. INTENDED AUDIENCE	10
6. VISUAL STORYBOARD	11
7. TECHNICAL PROCESSING OF DATA / HARVESTING	14
8. SOFTWARE DESCRIPTION OF FEATURES	16
DEVELOPED OR USED	

CREDITS & ACKNOWLEDGEMENTS

LINKS

SUMMARY OF THE PROJECT

In this project, modern and contemporary artworks are visualized according to the subjects they represent. This is done using the Tate Modern dataset, containing Avantgarde artworks which are indexed using the Subject index. This metadatum encodes the content of the artworks (i.e. People, Interiors, etc) in a hierarchical three-layer deep structure.

The concept is to reverse the navigation of art from the frequently used painter/year/title navigation to a semantic one. The peculiarity is that the art used is weakly representational or even abstract. Although this effort is almost contradictory in nature as this art has a tendency to move away from a pure semantic identification, this aggregation opens up new perspectives and new ways of looking at this art. It generates a reflection on the side of the user into which forms and colors in Avantgarde art can still determine its content. Practically, the visualization is articulated along the z-axis, navigating hierarchically the structure of the index. The starting page features 14 slideshows in a grid with slightly staggered boxes (as in Figure 1). Each slideshow contains the images of one of the subjects at the first level and the animation selects randomly a box that is updated at any time.

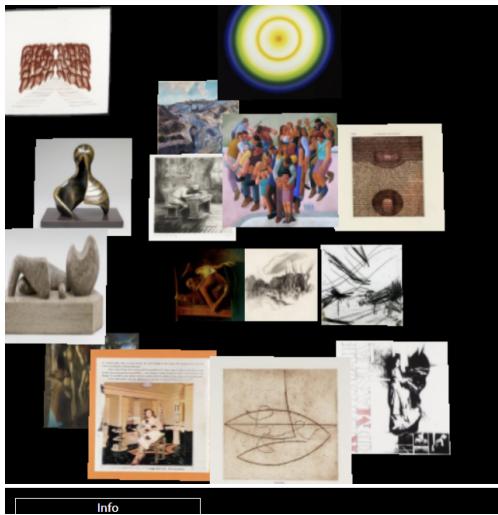


Figure 1: Homepage of the visualization

Double-clicking on one of the slideshows surpasses it in the z-axis. The choice of a subject is purely based on the visual slideshow as no text is given at this point. The second page then appears with slideshows of the sub-subjects of the second level (in the same way as the first). Double-clicking opens the third scene which contains the full list of images in the sub-subjects. These can be ordered by creation year, artist, acquisition year and medium. Double-clicking on another image finally reveals the metadata on the image, including which subjects and sub-subjects of the index are present in the image. At this point, the user has information on what are the possible subjects and sub-subjects they have clicked to get there and are encouraged to continue browsing the other images (going back with 'b') to determine which slideshow represents which subjects and sub-subjects.

INTRODUCTION TO THE ARCHIVE CHOSEN

TATE DATASET

This project adopts the publicly available [Tate Collection](#) for its visualization. It contains metadata and image URLs of over 70,000 artworks owned by the Tate Group jointly with the National Galleries of Scotland. The artworks available span from the 1800s to the current day, including both British and international artists. The Tate Group, comprised of Tate Britain, Modern, Liverpool and St. Ives is an ensemble of national museums of Great Britain. For this project, the subset of data belonging to Tate Modern, a modern art gallery located in London, was selected. It contains mostly modern and contemporary art from the last two centuries. The collection is one of the largest among modern art museums, spanning, among others, from Abstract Expressionism, to Pop Art, to Minimalism. The gallery is situated in the former Bankside Power Station, London.

The collection has been published on GitHub as part of the 5-year project of 'digital access, participation and learning with archives' (from [Transforming Tate Britain](#)) that started in 2012. The metadata has been dynamically updated until October 2014, when the GitHub repository stopped being maintained. The project, Archives & Access, has been funded by the Heritage Lottery Fund (HLF) and Tate. It focused on the digitisation of the Tate Collection (which is currently the world's largest archive of British art) and the development of interactive activities at Tate.

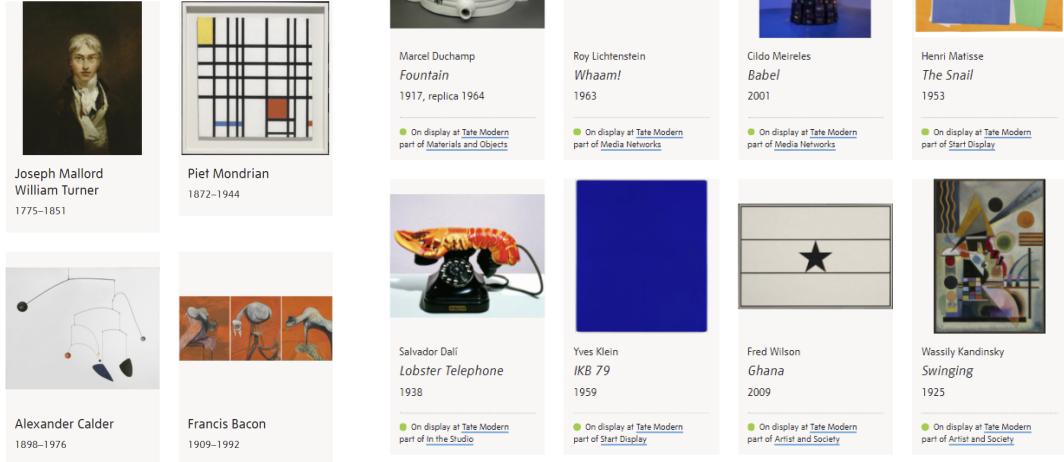
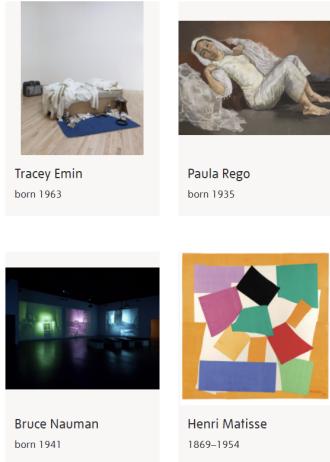


Figure 2: Sample artists from Tate Modern digitized art

Figure 3: Sample artworks from Tate Modern

INTRODUCTION TO THE ARCHIVE CHOSEN

Basic metadata for each artwork is available in CSV format and some more elaborate metadata (including the Subject index) in separate JSON files. The basic information includes the following: artist, accession_number (an ID of the artwork), medium, creation year, title, and acquisition year by Tate. Furthermore, the CSV contains links to download the images associated with each artwork. About 40,000 of them were available following the link both in thumbnail format (256x256 pixels circa) and in HD (1500x1500 pixels circa). The artworks are organized in 6 subsections: A, AR, D, N, P, T, each indicating a collection of the Tate Group. Only subsections P and T were used in this project as these contain the artworks by Tate Modern. The filtered dataset contains 3.000 images.

TATE AND SUBJECT INDEX

The metadatum used predominantly by this project is the Subject Index (as in Figure 4). The index was designed during the Archives & Access project and it represents what an artwork is 'about' and how the content relates it to other items in the collection (from (Subject) index to the soul). The index is an adaptation of the already existing art-historical classification system of ICONCLASS, a hierarchical thesaurus that organizes artworks into their content (from Hans van de Waal, ICONCLASS. An Iconographical Classification System. Completed and edited by Leendert D. Couprie, Els Tholen, a.o., Amsterdam 1972-1985). The subject index breaks down the information contained in an artwork into a set of predefined classes or themes and further divides each class into subclasses until reaching the third level of hierarchy. The classes and subclasses are mixes of traditional subjects represented in artworks and very abstract ones. At the first level, the classes include Group/movement; Emotions, concepts and ideas; History; Leisure and Pastimes, Literature; Nature; People; and Places, Architecture, Interiors.

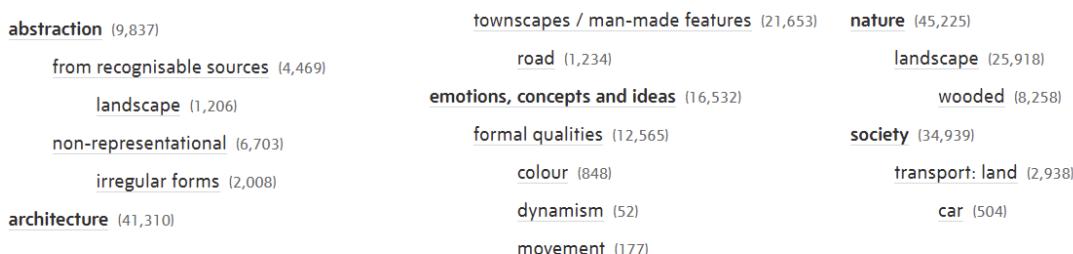


Figure 4: Subject index under Explore section of Balla, The car has passed.

INTRODUCTION TO THE ARCHIVE CHOSEN

For the user, the index provides a summary of individual items in the artwork and the possibility to group artworks by content, opening up their organization beyond their obvious art-historical interest. The index can be found by clicking on the 'Explore' section of an artwork's webpage. As one can see from the example in Figure 4, it is extremely detailed. It contains information in the form of a tree in which each class has a variable number of subclasses and the subclasses also have subclasses. The classes at depth one denote different domains contained in the image. In the instance above, the domains are Abstraction, Architecture, Concept Emotions and Ideas, Nature and Society. These indicate both the descriptive elements of the image (the road, wooded trees and a car) and the symbolic intent such as that of dynamism and movement.

The image this index refers to is shown in Figure 5. The artwork is part of a triptych named 'Abstract Speed'. In the painting, the passage of a car along a white road is depicted. The background, comprised of overlapping forms of green and blue represents nature and the sky. The criss-crossed shapes and strident colors represent the speed and noise of the car, whilst the use of pink gives the impression of an act that has just passed.

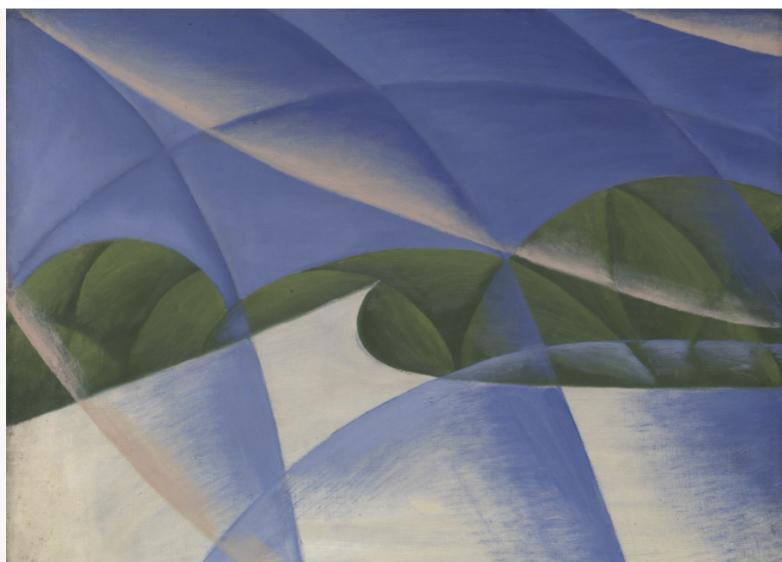


Figure 5: Image of Balla. The car has passed.

The different levels of the painting, from the abstraction of the forms and the symbolic intent, are all encoded in the index. In fact, the index can be seen as a thorough description of the artwork, going beyond the mere visual level.

INTRODUCTION TO THE DATA VISUALIZATION INTENT

In short, the intent of this visualization is to exploit the possibilities opened up by the Subject index on Modern and Contemporary art. As art belonging to the Avantgardes of these last two centuries witnesses often a detachment from forms and colors, the contenutistic and symbolic aspects of this art become progressively less directly associated with the forms and colors used to depict them. By presenting artworks organized by their index (and therefore their content), this project aims to stimulate the user into understanding what forms and colors are distinctive of certain contents. It aims to do so for Avantgarde art, as this association of forms and colors to contents is weak.

PANOFSKY AND ICONOGRAPHY

In order to better understand what this weak association implies, let us look at Panofsky's iconographic system (from Van Straten, R. (1986). Panofsky and ICONCLASS. *Artibus et historiae*, 165-181.). The system comprises three levels as in Table 1. The first being the 'primary or natural subject matter' of an artwork, the second the 'secondary [...] subject matter, [...] of images, stories, allegories' and the third representing the 'symbolical values'.

OBJECT OF INTERPRETATION	ACT OF INTERPRETATION	EQUIPMENT FOR INTERPRETATION	CONTROLLING PRINCIPLE OF INTERPRETATION	HISTORY OF TRADITION
I—Primary or natural subject matter - (A) factual, (B) expressional, constituting the world of artistic motifs.	Pre-iconographical description (and pseudo-formal analysis).	Practical experience (familiarity with objects and events).	History of style (insight into the manner in which, under varying historical conditions, objects and events were expressed by forms).	
II—Secondary or conventional subject matter, constituting the world of images, stories and allegories.	Iconographical analysis in the narrower sense of the word.	Knowledge of literary sources (familiarity with specific themes and concepts).	History of types (insight into the manner in which, under varying historical conditions, specific themes or concepts were expressed by objects and events).	
III—Intrinsic meaning or content, constituting the world of 'symbolical values'.	Iconographical interpretation in a deeper sense (Iconographical synthesis).	Synthetic intuition (familiarity with the essential tendencies of the human mind), conditioned by personal psychology and 'Weltanschauung'.	History of cultural symptoms or 'symbols' in general (insight into the manner in which, under varying historical conditions, essential tendencies of the human mind were expressed by specific themes and concepts).	

Table 1: Table describing Panofsky's iconographic system. From Van Straten (1986).

INTRODUCTION TO THE DATA VISUALIZATION INTENT

The first level is the most straightforward in an artwork: it investigates how the content is expressed by forms. Representational art can be well explained in terms of this first level: i.e., a portrait representing a woman will be depicted with the appropriate forms and style to create the likeness of a woman. The second level, on the other side, requires knowledge of literary sources, as it entails understanding which themes and concepts are being represented by the forms. In the example above, the knowledge of who the woman is and how portraits represent an expressive medium constitutes the second level. Finally, the third is the most profound level, where the symbols of the artwork and the deepest intentions of the artist are identified. This level is extremely specific to each painting, thus no general example can be given.

AVANTGUARDES ART

The example given above was based on traditional representational art, however, this project deals with Avantgardes artworks. It is, therefore, important to understand what the difference between Avantgarde art and representational art is. (Note that this section is purely speculative and based on my own perception of this change.) As introduced above, in my opinion, the main difference between the two periods is the weakened association of forms and colors to content. Looking back at art history, this process can be grossly attributed to four moments: the shift from a truthful depiction of reality to a general depiction of an impression, around the years of 1860-70s, mostly with Impressionism; the shift towards the simplification to elementary geometrical shapes, around the years of 1890-1920s, predominantly with Cubism; the shift towards anti-naturalistic colours, around the years of 1890-1920s, predominantly with Expressionism; and, finally, the shift to Abstraction, with the 'dissolution of matter and pure composition', the absence of the outer world and the complete dominance of the inner, which was achieved around the years of 1920-50s (V. Terraroli, *Lezioni di storia dell'arte: Il Mediterraneo dall'antichità alla fine del Medioevo*. Skira, 2001, vol. 1 and W. Kandinsky, *Concerning the spiritual in art*. Courier Corporation, 2012).

INTRODUCTION TO THE DATA VISUALIZATION INTENT

For example, if we go back to Balla's *The car has passed*, the depiction does not present any visual detail that links the present shapes to a car, a landscape and a road. The forms are extremely simplified into elementary geometric shapes and are only aimed at giving an impression of the depicted content. The colors, furthermore, are few and evocative rather than naturalistic.

ICONOGRAPHY IN AVANTGUARDES ART

Given that the forms and colors are no longer so directly associated with their content, the question of what iconography means for Avantgarde art has to be addressed. Avantgarde art, having severed the direct link between the content represented and the figurative means to do so, has eliminated the first level of iconography from the picture. The first level, in fact, would often be limited to listing a number of shapes and primary colors. Elements such as Nature, People, Architecture immediately become secondary levels of Iconography. In the example of Balla, the recognition of the car and the road are only possible knowing the expressive means of Futurism and the use of forms and colors to represent dynamism.

In this sense, what is interesting about having to mentally organize artworks into their subjects and recognizing what each set of artworks represent is that the user is asked to jump to the second level of iconography, without being able to rely blindly on the first. Associations should therefore be made based on art-historical principles, on intuitions and on abstractions over the forms and colors.

CONCEPT MAP

Conceptually, the project envisages three spheres interacting with each other. The ultimate goal is to find the first sphere: the iconographic/semantic one. Each box in the visualized grid represents one semantic content and is given a certain depth based on how symbolic the class is (0 is only conceptual, 1 is completely symbolic). The user, when reflecting on this sphere, is asked to use their intuition and knowledge to understand which content is represented by which set of images. The first means to understand the first sphere is the second sphere: the visual one. From each image in the grid, the user is asked to trace the visual similarities to other images of the same class. Once a class and a subclass are clicked and the user ends up on one image, the third sphere appears: the text. This contains written information on the semantic sphere. The text indicates which classes and subclasses belong to an image but not which ones were clicked by the user. Therefore, the text gives a direction in finding out the first and second sphere, but it also encourages the user to go back to the second sphere to better inform the first. Only by using the second and third sphere correctly, the user can achieve the first sphere.

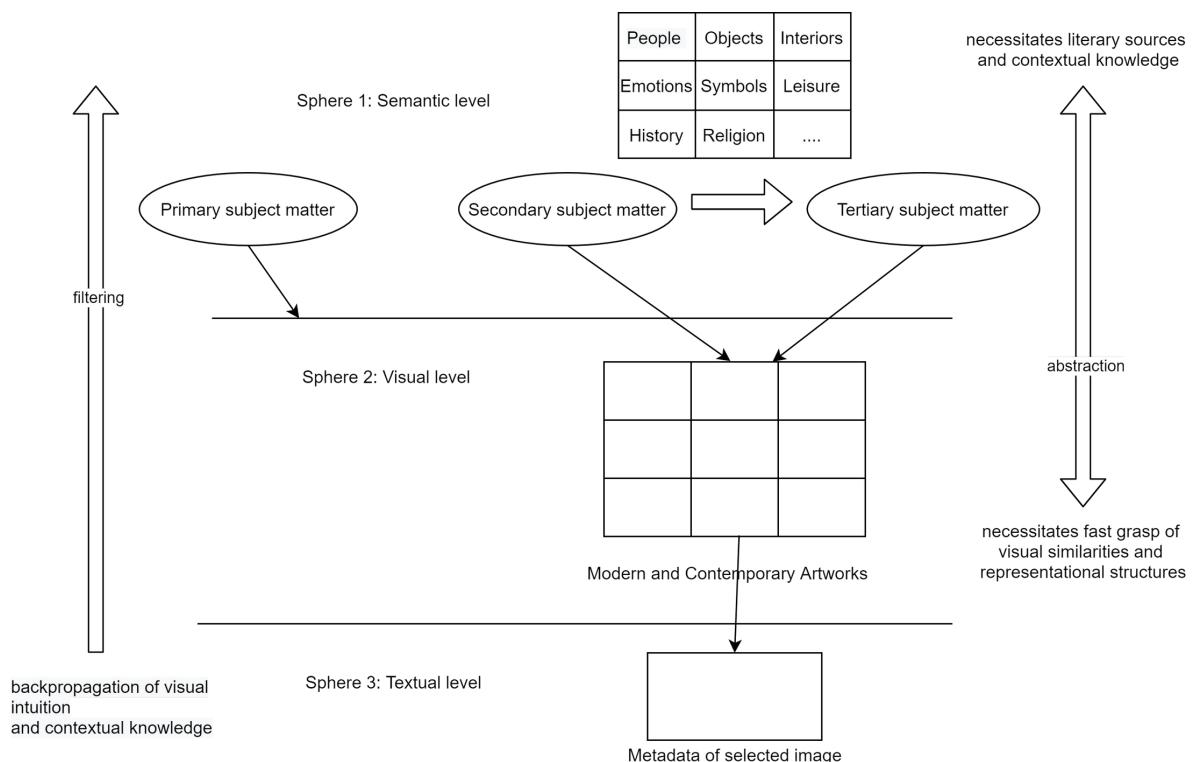


Table 2: Concept map visualizing the three spheres of the project: Semantic, Visual and Textual

INTENDED AUDIENCE

The goal of the visualization is to create an immersive mental experience, where the user engages with an open mind, trying to create new visual-semantic connections based on what is being presented. Based on this, any user willing to reflect on the visualization can be viewed as the target audience. At the same time, for a more comprehensive experience, a basic art historical background is required. The connections that an inexperienced user can make would not be informed by the representational techniques of the specific periods/authors, and therefore remain rather partial. However, the riddle-like experience of this visualization might elicit some curiosity in the inexperienced user, and they would then search on the internet (or Tate website) for more information about an artwork or artist. Therefore, this project can be understood at different levels and each level provides a different experience for the user.

This visualization can further be used for studies on iconography, semiotics, and Avantgardes. In particular, a useful application could be situated in the studies on the evolution of the representational means of a specific class/subclass over the last two centuries. For example, if one were to study the evolution of the iconography of Nature, one could look at the class nature, see which are the subclasses, what elements of each subclass are most telling to understand what it was. One could then enter the subclass and order all the images contained in the subclass by year, obtaining a very visual view of how these evolved over time.

VISUAL STORYBOARD

Table 3 contains the Storyboard that was made to visualize this project around the very beginning of the process. The project contains 4 scenes that progress from the most general to the most particular one. The first scene contains 14 slideshows of images of the 14 classes at the first level. The slideshows can be activated by clicking 's' and stopped again by clicking the same button. Double-clicking on one slideshow of the first page opens the second page. This contains the slideshows of the subclasses of the clicked class. Clicking 'b' goes back to the scene before, and this works for all scenes. Orbit controls can be used at all scenes to manipulate the view of the images. One can zoom, tilt and move in all directions. The button 'r' resets the view to the original one. Double-clinking again goes to the third scene, where all the images of the subclass are shown. The order in which the images are shown can be customized by clicking the buttons that appear at the top of the screen. Finally, double-clicking again on an image goes to the final scene where the image clicked is presented with the related metadata.

In the next page, more will be explained about each scene.

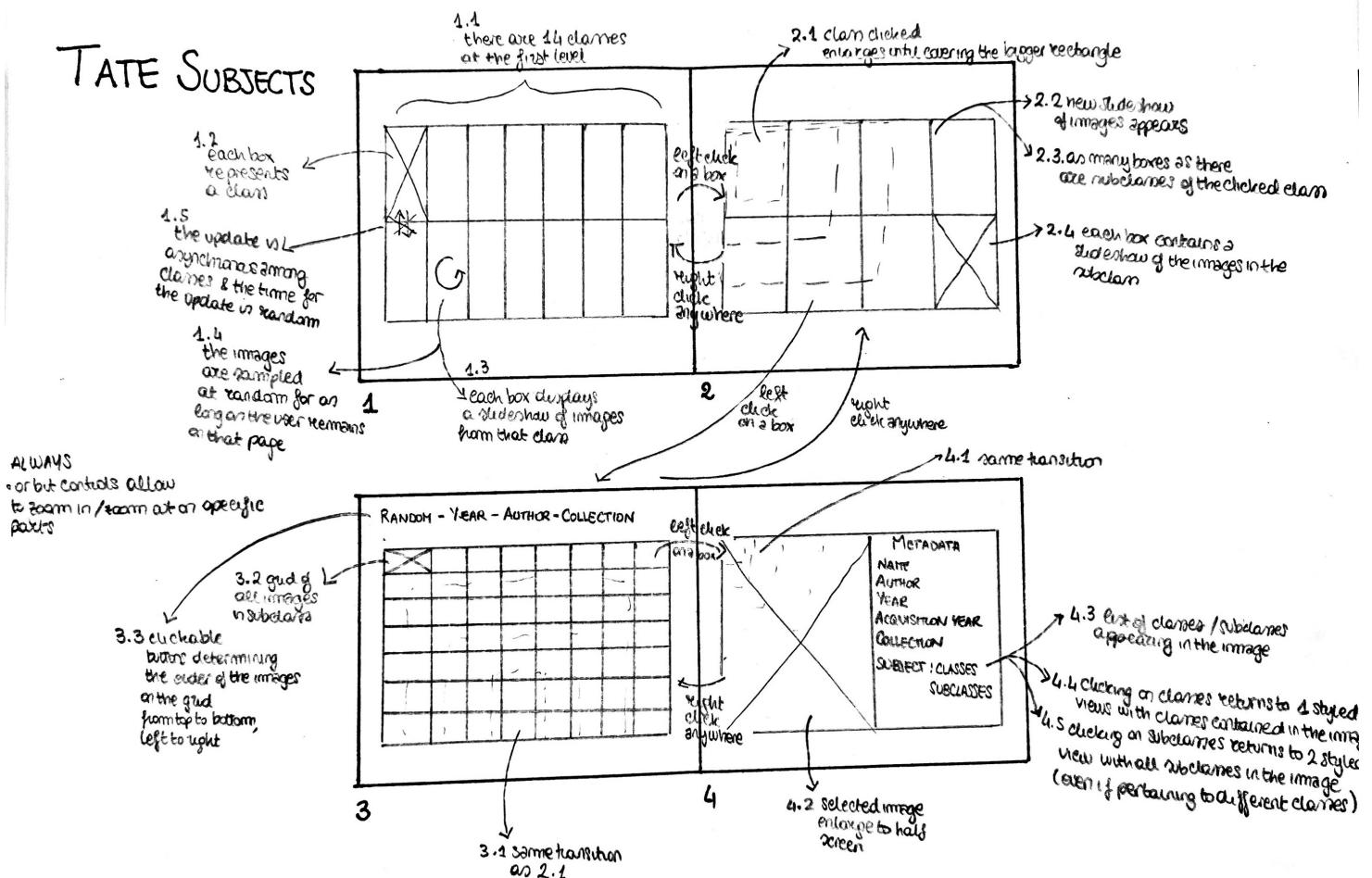


Table 3: Visual Storyboard of the project. The storyboard comprised of 4 scenes, descriptions of different elements in each scene and transitions from one scene to another

VISUAL STORYBOARD

Homepage & Second Page

As introduced above, the first scene represents the most general/high-level view on the dataset. A grid of 14 boxes is shown. Each box contains one image at any point in time belonging to the class represented by the box. The depth of the box is determined by how symbolic the class is. The values are given manually: classes such as People or

Interiors are considered not symbolic (circa 0 z-axis value), while symbols & personifications or Emotions Concepts and Ideas are the most symbolic (circa 1 z-axis value). The more symbolic the closer to the eye. Each image in a box is updated at a random rate with a random image of the same class to create the slideshow. No text is included in this scene. Clicking on a box makes the whole scene transition closer to the viewer until disappearing and the second scene appearing. This creates the feeling of moving deeper into the visualization and following the hierarchical structure of the index. The second scene mirrors the same structure as the first.



Images 6 & 7: Screenshot of the homepage with normal orbit setting s (left) and tilted sideways (right) to see the depth of the classes.

Third Page

After clicking on a subclass on the second level, the same transition takes place and the third level appears. This contains all the images of the subclass chosen. These are originally ordered by artist, but also creation year, medium, and acquisition year can be chosen as principles to order the images. The order starts from the top left and moves first down then right. The different ordering strategies allow the user to obtain different global views of the subclass, and to extract what features

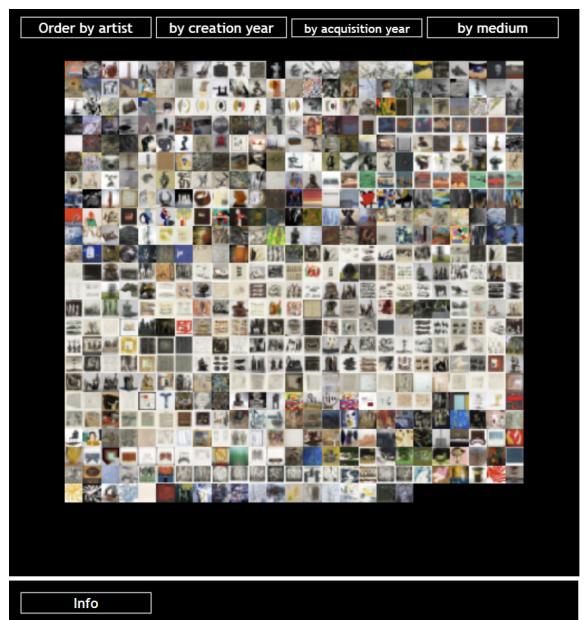


Image 8: Screenshot of the third scene.

VISUAL STORYBOARD

of the subclass change in time, by artist, medium and according to when they were purchased by Tate.

FINAL PAGE

When clicking on one image, the fourth scene appears. This carries the related metadata of the image and is the first scene containing text. The metadata gives information on the title of the artwork, the artist, year, medium, acquisition year and classes and subclasses applicable to the image. Each image normally contains multiple classes and even more subclasses, thus, the text does not unequivocally tell which class has been chosen at the first level and which subclass at the second level. However, it allows the user to rule out some options and to see which ones are available. Going back to the second and first level and selecting new images allows the user to refine further and further the guesses of which are the classes and subclasses selected. This choice of adding text only at the end of the visual selection, is intended both not to disturb the visual experience and to create the need to dive deeper and broader into the visualization.

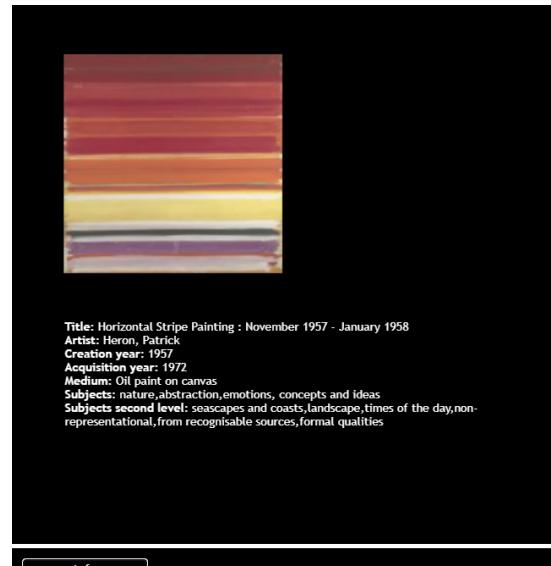


Image 9: Screenshot of the final scene.

TECHNICAL PROCESSING OF DATA / HARVESTING

RETRIEVAL

In order to retrieve the data, the Github of the Tate Collection was cloned. The library 'wget' in python was used to download the thumbnail formats of the images from the URLs contained in the CSV file. The images downloaded were then uploaded on Cloudinary for online hosting. This allows loading the images on the visualization using an API call instead of storing them in memory. Subsequently, to call the images from the visualization, the Cloudinary links of each image were retrieved. This was done using the 'Cloudinary' library in python and the expression search tool to which I inputted the original name of the files and it returned the related link. Finally, the subject metadata was added to the CSV files from the JSON files. This process proved rather tricky as each JSON file was stored in a different folder based on the initial characters of its 'accession number' (the ID of the artwork). Therefore, the list of folders to scrape had to be made from the accession numbers, the names of the JSON files in each folder were then obtained using the library 'glob' and finally the content of each JSON had to be linked back to the accession number and merged with the CSV.

JS FILES

Once the complete dataset was achieved, a number of javascript files were generated to be used by the visualization. Note that all the files were originally made in JSON format and manually converted to .js to be easily imported in the javascript visualization. The files that were produced are the following:

- 1to2: which contains a mapping from the subjects of the first level to the corresponding subjects of the second level. This was used for obtaining the grids to display after clicking on the first level class.
- id2url: which contains a mapping from the image name (accession number) to the URL where the image is hosted. This was used to access the URL after an image id to display is sampled at any level.
- metadata: which contains all the metadata of each image and can be accessed by image id. It is used for the 4th screen where the image is displayed alongside the metadata.
- subj1id: which contains the list of images belonging to each subject at level 1. It is used to sample the images that have to be shown in each box of the grid on the homepage.

TECHNICAL PROCESSING OF DATA / HARVESTING

- subj2id: which contains the list of images belonging to each subject at level 2. It is used to sample the images that have to be shown in each box of the grid of subclasses in the 2nd screen.
- order2subj: which contains data for each subclass ordered by different factors (medium, artist, year, acquisition year) and accessible first by subclass name and then by order name (i.e., medium, artist, year, acquisition year). It is used in the third screen to display the images ordered by the above factors.

All the files were made and manipulated using the 'numpy' and 'pandas' python libraries.

SOFTWARE DESCRIPTION OF FEATURES DEVELOPED OR USED

GITHUB, HTML, CSS, THREE.JS

The visualization is hosted on Github using the Github Pages features to be accessible on the dedicated .io webpage. The repository contains an HTML index file which loads the useful files and defines the canvases used. The visualization has a main canvas containing most of the content, a bottom section containing the 'Info' button (which opens a pop-up containing information on the possible actions and key-presses) and a top one which contains the buttons for ordering the images and appears only at the third screen. Furthermore, a basic styling file 'style.css' was added to customize the buttons and text. Finally, the bulk of the visualization was made using raw javascript code and functions in Three.js.

JS

The features present in the visualization were mostly built from scratch and a few were imported from the library Three.js and OrbitControls.js. The most important ones borrowed from the two libraries are:

- the orbit control system where the user can control the view. Clicking the left mouse button and dragging the view rotates around the origin, transforming the mouse movement into rotations, clicking the right mouse button and dragging the view translates along x and y axes. The mouse wheel is used to zoom in and out of the z-axis,
- the perspective camera (Three.js) definition which sets the user view,
- the scene definitions together with the related plane geometry instantiation and basic mesh material definition (Three.js) which create the main squares.

Regarding the features implemented directly using raw javascript code, the most important ones are the following:

- layer definition: performed every time the user transitions from one scene to another. It instances the following layer and makes the previous one invisible (this is, however, still kept in memory in order to be able to go back to it at any time). Once the geometry is instanced, the first image of each class is rendered on the geometry with basic mesh and the coordinates are computed placing N geometries (where N is the number of classes) inside the square (so each row having root N geometries).

SOFTWARE DESCRIPTION OF FEATURES DEVELOPED OR USED

- picking: is performed when the user double-clicks the left mouse button. The system projects the vertices of all the tiles in screen coordinates and then identifies the selected tile. This operation works correctly even if the view has been changed by the Orbit Controls.
- animation: occurs in the first two scenes. A clock is instanced and every time the clock reaches 200 milliseconds (number that can be increased or decreased by pressing '-' or '+'), a box is chosen at random and an image belonging to the class of the box is chosen again at random. The chosen image is updated on the texture of the chosen box and the clock is restarted.
- transition: occurs in the first three scenes. This is very basic and to improve in the future centering the movement on the selected class. The current scene is moved closer to the eye (along the z-axis) in 70 equal steps until disappearing beyond the camera perspective scene. The following scene is also moved closer to the eye with the same principle, starting from far and reaching 0 for the z-axis.

CREDITS & ACKNOWLEDGEMENTS

This project draws largely on the theoretical framework explained by Van Straten, R. (1986). Panofsky and ICONCLASS. *Artibus et Historiae*, 165-181. Most of the information about Tate and Balla's work were retrieved directly from [Tate's website](#). Furthermore, most of the information in the art-historical section on Avantgardes was browsed from my high school book: V. Terraroli, *Lezioni di storia dell'arte: Il Mediterraneo dall'antichità alla fine del Medioevo*. Skira, 2001, vol. 1 (cit. on p. 29) and W. Kandinsky, *Concerning the spiritual in art*. Courier Corporation, 2012 (cit. on pp. 29, 34).

The design and presentation principles have largely been inspired by principles seen in class or during the guest lectures. Particularly, the concept of proposing new ways to organize data in order to open new horizons of knowledge was the guiding principle of this project.

LINKS

Link to visualization: https://ludovicaschaerf.github.io/TATE_Subjects/